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***Candelariella*, *Ochrolechia*, *Physcia*, and *Xanthoria*
species new to Turkey**KENAN YAZICI¹*, ANDRÉ APTROOT² & ALI ASLAN³¹Biology Department, Science Faculty, Karadeniz Technical University, 61080, Trabzon, Turkey²ABL Herbarium G.v.d. Veenstraat 107, NL-3762 XK Soest, The Netherlands³Biology Department, Kazım Karabekir Education Faculty, Atatürk University, Erzurum, Turkey*CORRESPONDENCE TO kcagri_1997@yahoo.com

ABSTRACT — *Candelariella kuusamoensis*, *Ochrolechia frigida*, *Physcia phaea*, and *Xanthoria papillifera* were determined as new to Turkey and the Middle East following a recent lichenological foray in Iğdır and Van regions (Turkey). Geographic distribution, substrate, chemistry, and comparisons with morphologically similar taxa are presented.

KEY WORDS — *Ascomycetes*, biodiversity, lichen

Introduction

Although many lichen taxa have recently been recorded for Turkey (Candan et al. 2010, Candan & Halici 2009, Halici et al. 2010a,b, Kinalioglu 2009, Kinalioglu & Aptroot 2010, Kinalioglu 2010a,b,c, Karagöz et al. 2011, Perez-Ortega et al. 2010, Yazici & Aslan 2009, 2010a,b), the lichen biota of many regions are still unknown. No lichenized fungi have thus far been reported for the Iğdır region, although some surveys of lichens have been conducted in the neighbouring Ardahan region (Osyczka et al. 2011, Yazici et al. 2010a,b) and 81 taxa were reported from the Van province (Aslan & Öztürk 1995, Szatala 1941, 1960, Şenkardeşler & Lökös 2010). Ten *Candelariella*, fifteen *Ochrolechia*, sixteen *Physcia*, and twelve *Xanthoria* taxa have previously been reported from Turkey.

The climate of the Iğdır region is characterized by hot dry summers and cold snowy winters. The mean annual temperature is 11.6°C, average humidity is 63%, and the mean annual rainfall is about 257.6 mm. Summers are characterized by moderate precipitation and the winters are generally marked with high precipitation (Akman 1999).

The Iğdır region has few forested areas and is dominated by steppe. Mountain Zordağ (Iğdır: Center), which is exposed to high light conditions, is a windswept

area with gently sloping terrain dominated by grass, rocks, and streams with scattered coniferous and deciduous trees. *Prunus*, *Pyrus*, *Populus*, *Salix*, and *Elaeagnus* trees are seen occasionally along the stream between Taşköprü and Karaca villages (Tuzluca) (Baytop & Denizci 1963). There are no trees but many calcareous and siliceous rocks in the Taşucan and Bahçecik villages, an exposed windswept area.

The Van region has a continental climate, characterized by long cold snowy winters and hot dry summers. The mean annual temperature is 9°C, average humidity is 51.10% , and the mean annual rainfall is about 380 mm, with a precipitation range of 370–570 mm (Akman 1999). The collection sites are exposed to high light conditions and windswept with gently sloping terrain comprising grass and volcanic calcareous rocks. A river valley with trees was sampled only in Saray town (Van). In the other regions of the Van district there are no deciduous or coniferous trees (Baytop & Denizci 1963).

Material & methods

During a recent lichenological research foray in Iğdır and Van regions (Turkey), lichen samples were collected from 07 December 2008 to 27 September 2009 and 13 June 2010 to 12 July 2010. Air-dried samples were examined with a Nikon SMZ1500 stereomicroscope and a Nikon Eclipse 80i light microscope. Identifications were determined by consulting appropriate keys in the literature (Brodo et al. 2001, Dobson 2005, Kärnefelt 1990, Kukwa 2009, Moberg 1977, Poelt 1974, Poelt & Vězda 1981, Redchenko et al. 2010, Smith et al. 2009, Thomson 1997, Wetmore 2005, Wirth 1995). Secondary metabolites were identified by the usual spot tests.

Vouchers are stored in the herbarium of the Biology Department, Science Faculty, Karadeniz Technical University, Trabzon, Turkey (KTUB) and the Biology Department, Kazım Karabekir Education Faculty, Atatürk University, Erzurum, Turkey (ATA-KKEF).

Species recorded

Candelariella kuusamoensis Räsänen, Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo, 12(1): 56.1939

FIG 1

Thallus muscicolous, thick, dense, granular-warty, yellow to orange-yellow, to 3.2 cm in diam., almost cushion or aggregated break parts-like, to deep areolate cracks, consisting of closely crowded large granules (0.1–0.7 mm), upper surface uneven, yellow. Medulla green. Apothecia rare, to 0.25–1 mm diam., asci clavate, *Candelaria*-type, 12–32-spored, ascospores 9–15 × 4.5–5.5 µm, non-septate, hyaline. Algae trebouxoid. Hypothecium hyaline; hymenium hyaline, c. 65–70 µm high. Paraphyses 2.5–3 µm thick. Cortex K –, C –, KC –, P –. Medulla K –, C –, KC –, P –. Thallus contains pulvinic acid.

Candelariella kuusamoensis grows on moss, plant remains, soil, more rarely on rocks and wood and wooden fences, and on the top of poles in alpine areas.



FIG. 1. *Candelariella kuusamoensis*, habitus. Scale = 1 mm

Previously known from Asia, Europe, and North America. New to Turkey and the Middle East.

SPECIMEN EXAMINED: TURKEY. IĞDIR: CENTER, Zordağ mountain, 39°45'49.05"N 43°53'20.13"E, on mosses, 2400m, 13.06.2010, (leg. K.Yazici,) KTUB-2023.

Ochrolechia frigida (Sw.) Lynge, Lich. Nov. Zemlya: 182.1928

FIG 2

Thallus crustose, muscicolous, to 1.2–2 cm diam., ± orbicular, thin crust or thick granules, effuse, ± verrucose, uneven-granulate, occasionally with few cylindrical-coralloid and branching spinulose extensions, whitish to yellow-white, pinkish or gray, soralia rare. Apothecia rare, to 1 mm wide, sessile to adnate; margin thin to slightly thickened, entire or wrinkled; disk flat, red-brown, slightly roughened, epruinose. Hypothecium dull brown; epihymenium brown; hymenium 130–180 µm, hyaline; paraphyses slender; Asci 8-spored, ascospores simple, ovoid, 26–43 × 15–26 µm. Cortex K–, C+ red, KC+ red, P–; medulla K–, C+ red, P–; disc K–, C+ pink to red, KC + red, P–. Thallus contains gyrophoric acid, ± variolaric acid.

Ochrolechia frigida is a bipolar lichen, occurring mainly on soil, mosses, humus, plant remains, and at the base of plants. It is especially found in raised bogs on mountain tops in arctic-boreal and alpine regions in the northern

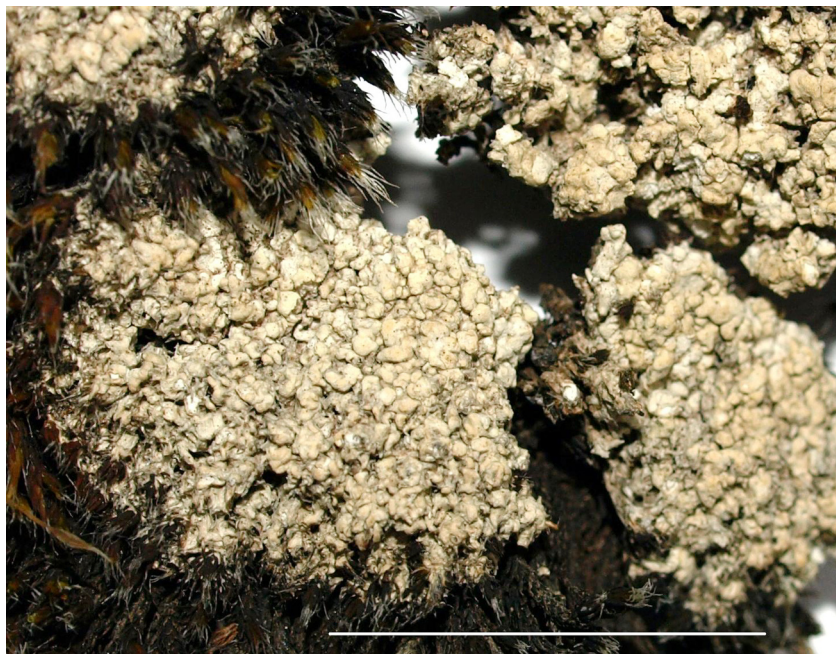


FIG. 2. *Ochrolechia frigida*, habitus. Scale= 1cm

hemisphere. Previously known from Antarctica, Asia, Australasia, Europe, North America, and South America. New to Turkey and the Middle East.

SPECIMEN EXAMINED: TURKEY. IĞDIR: TUZLUCA, between Taşköprü-Karaca villages, 39°52'07.40"N 43°28'57.94"E, 2134m, 14.6.2010, (leg. K.Yazıcı,) KTUB-2038.

REMARKS— *Ochrolechia frigida* differs from *O. upsaliensis* and *O. alaskana* in its smaller ascospores ($25\text{--}40 \times 15\text{--}26\ \mu\text{m}$) and apothecia (*O. upsaliensis* has ascospores $55\text{--}75 \times 26\text{--}38\ \mu\text{m}$). Also, *O. alaskana* has variolaric acid, which *O. frigida* lacks (Kukwa 2009). In addition, the thallus of *O. frigida* is delicate, grey, brown-grey, or brown, occasionally with a yellow tinge and distinct, branched spines, while the thallus in *O. alaskana* is thick and firm with a yellow tinge, and spines are lacking or occur occasionally in some specimens.

Physcia phaea (Tuck.) J.W. Thomson, Beih. Nova Hedwigia 7: 54. 1963

FIG 3

Thallus $\pm$ orbicular, or irregular, to 1.5–2.2 cm in diam., usually closely appressed to the substratum, steel-gray to dark gray, or brownish gray, white maculae present, rugose; pruina, soredia, isidia or lobules absent; lobes radiating, flat to slightly convex, 1–1.5 mm wide, typically crowded and overlapping, eciliate. Medulla white. Lower surface white to dark gray or brown, with white to black rhizines. Lower surface pale tan to brownish, with abundant



FIG. 3. *Physcia phaea*, habitus. Scale= 1mm

or sparse pale to brown rhizines, 0.3–1mm long. Apothecia numerous, 0.5–1.5 mm diam., margins lecanorine, crenulated when young, perfectly round and somewhat raised; disc dark brown to black, rarely covered with a white pruina; ascospores brown, 1-septate, *Physcia*-type, $16\text{--}20 \times 7\text{--}9\text{ }\mu\text{m}$. Cortex K + yellow, C + slightly yellow, KC + slightly yellow, P –. Medulla K + yellow, C –, KC $\pm$ yellow, P –. Thallus contains atranorin and zeorin. Pycnidia numerous; conidia immersed, subcylindrical, $4\text{--}6 \times 1\text{ }\mu\text{m}$.

Physcia phaea occurs mainly on granitic (less commonly, calcareous) rocks, or mosses (mostly in open areas), also on basaltic or gneissic and nutrient-enriched rocks. Previously known from Asia, Australasia, Europe, and North America. New to Turkey and the Middle East.

SPECIMENS EXAMINED: TURKEY. IĞDIR: TUZLUCA, Taşucan village, $39^{\circ}51'26.61''\text{N}$ $43^{\circ}35'41.06''\text{E}$, on calcareous rock, 3168m, 02.07.2010, (leg. K.Yazici), KTUB-2039. VAN: BAŞKALE, Başkale-Aşağı Dikmen Yol Ayrımı, Çamlık Köprü Mevkisi: $37^{\circ}57'09''\text{N}$ $44^{\circ}05'35''\text{E}$, on calcareous rock, 1886 m, 29.04.2009, (leg. A.Aslan), ATA-KKEF-1951; GEVAŞ, Akdamar Adası Karşısı, Akdamar Camping Yanı, $38^{\circ}18'32''\text{N}$ $43^{\circ}02'24''\text{E}$, on calcareous rock, 1662 m, 05.09.2009, (leg. A.Aslan), ATA-KKEF-1955; CENTER, Gedikbulak Köyü, Tuzla Karşısı, $38^{\circ}51'13''\text{N}$ $43^{\circ}26'32''\text{E}$, on calcareous rock, 1723 m, 07.09.2009, (leg. A.Aslan), ATA-KKEF-1954, Van Kalesi, $38^{\circ}30'14''\text{N}$ $43^{\circ}19'56''\text{E}$, on calcareous rock, 1681 m, 07-11.12.2008, (leg. A.Aslan), ATA-KKEF-1953, Erek Dağı Doğu Yamacı: $38^{\circ}29'59''\text{N}$ $43^{\circ}29'22''\text{E}$, on calcareous rock, 1976 m, 01-05.10.2008, (leg.

A.Aslan), ATA-KKEF-1950; ÇALDIRAN, Çaldıran Çıkışı, 39°08'07"N 43°55'45"E, on calcareous rock, 2053 m, 28.04.2009, (leg. A.Aslan), ATA-KKEF-1952.

REMARKS— *Physcia phaea* resembles *P. aipolia* and *P. cascadiensis*, but is distinguished from *P. aipolia* by occasionally growing on a bark and having apothecia that lack soralia and the heavy pruina characteristic of *P. aipolia*. *Physcia cascadiensis*, a rare and rock-dwelling rosette lichen, like *P. phaea* lacks soredia and has a K + yellow medulla but differs in its very pale gray cortex, absence of maculae, and pruinose apothecia.



FIG. 4. *Xanthoria papillifera*, habitus. Scale= 1mm

Xanthoria papillifera (Vain.) Poelt, Mitt. Bot. Staatss. München 2: 29.1954 FIG 4

Thallus crustose, small, to 5–15 mm diam., forming ± appressed, ± orbicular, rosettes, reddish-orange, orange-yellowish; lobes well-developed, inflated to flattened, or pulvinate, 0.4–0.6 mm wide, 1.5–1.8 mm long, separate or ± overlapped high-arched, curved, ± deeply lobed, mostly clearly separated. Soredia scattered and isidia-like; isidia dense mostly central regions of the thallus, coralloid or papillate, finger-like, pruinose, uniformly thick. Apothecia rare, lecanorine 0.2–0.5 mm diam. Asci 8-spored, ascospore 1-septate, colourless. Cortex on upper and lower thallus with hyphae ± perpendicularly oriented to the upper surface, attached by rhizines or adhering discs. Cortex K + purple, C + orange turning orange-brown, K + orange-brown, P –. Medulla K –, C –, KC –, P–. Apothecia K + purple. Thallus contains anthraquinones.

Xanthoria papillifera grows on steep surfaces of calcareous and siliceous rocks, boulders, and mossy soil, often in montane areas. Previously known from Africa, Asia, Australasia, Europe, and North America. New to Turkey.

SPECIMENS EXAMINED: TURKEY. IĞDIR: CENTER, Zordağ mountain, 39°45'49.05"N 43°53'20.13"E, on calcareous rock, 2400m, 13.06.2010, (leg. K.Yazici) KTUB-2022; TUZLUCA, Bahçecik village, on roadside, 40°04'05.63"N 43°25'35.47"E, on calcareous rock, 1754m, 12.07.2010, (leg. K.Yazici), KTUB-2021. VAN: SARAY, Saray-Kapıköy Yolu Kaz Gölü Civarı, 38°32'06"N 44°15'21"E, on calcareous rock, 2180 m, 27.09.2009, (leg. A.Aslan), ATA-KKEF-1957; ÇALDIRAN, Tendürek Dağı, Uzunyol Köyü, 39°19'08"N 44°01'56"E, on calcareous rock, 2351 m, 27.04.2009, (leg. A.Aslan), ATA-KKEF-1956.

REMARKS—*Xanthoria papillifera* is similar to *X. sorediata*, which is distinguished by rounded to flattened lobes and sorediate isidia. This species has also been called *Xanthoria domogledensis* Vězda.

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